IEEE802.3at Task Force
Classification ad hoc group

Flexible PD implementation driven Architecture

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PowerDsine

Purpose of this presentation

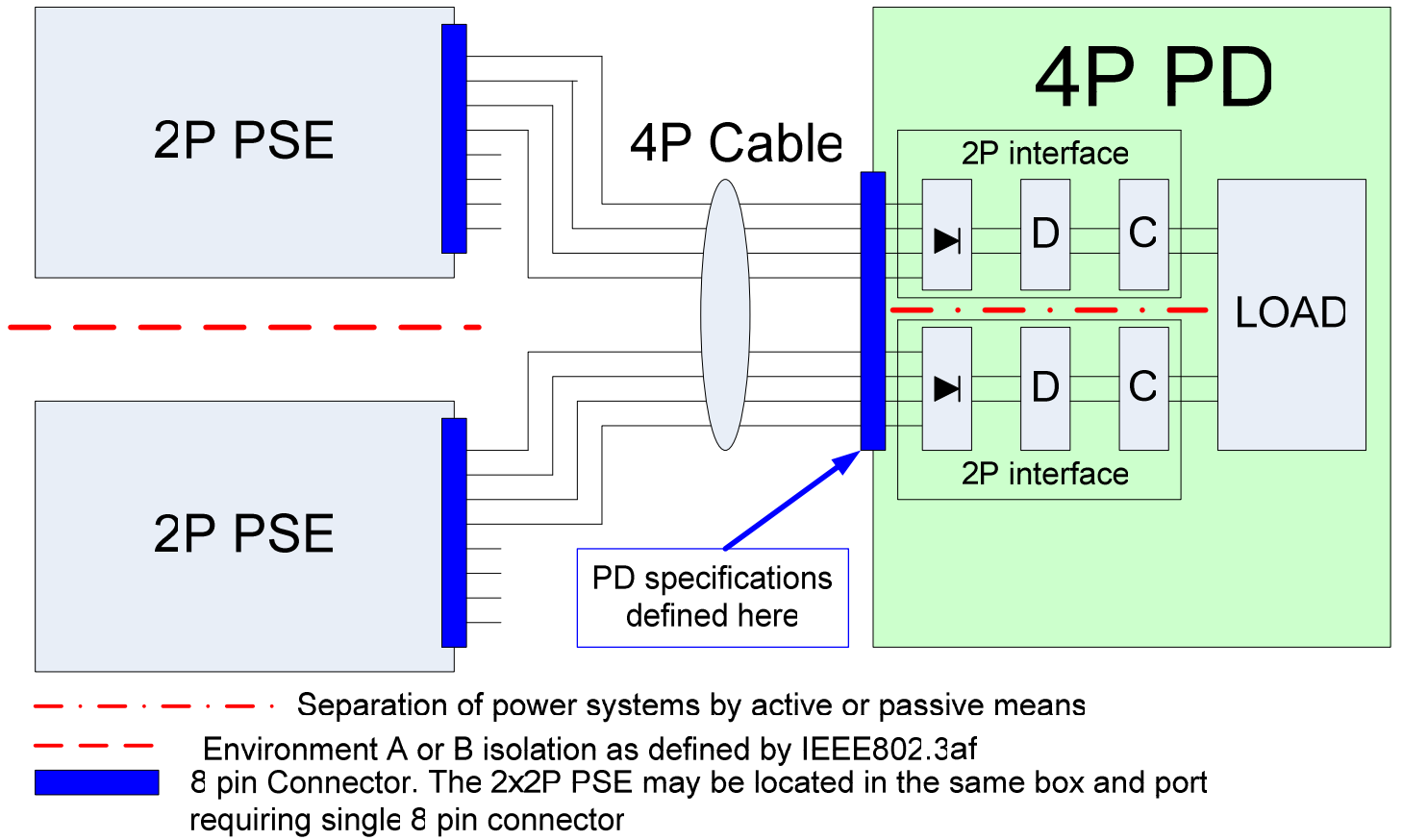
- Focus on system architecture that
  - allows flexible PD implementations and applications
  - allows simple and clear standard

Terms and Abbreviations

- MP = Medium Power, 12.95W<P<MP [Watts]
- HP= High Power = 2x MP
- HP PD=A PD that get power from both pairs simultaneously to form max 2xMP [Watts]
- SS = Single Detection and Classification Signature
- DS = Dual Detection and Classification Signature
- P=Power [W]
- O = Need to be met by objectives
- 5C= Need to be met by 5 Criteria

Suggested Architecture

- 2P System is the basic building block
- 4P system is constructed by 2 x 2P system. At least one of the 2P includes data capabilities.



Suggested Architecture Principles

- 2P System is the basic building block
- 4P system is constructed by 2 x 2P system
- Hence a PD that requires power over 4 pairs should advertise detection and classification signature for each 2P.
- Classification signature may be different for each 2P.
- Each 2P has its Status and Indications parameters
- System decides how to treat effects of cross status and indications. E.g : in a 4P system, Channel 1 overloads. Channel 2 still works. System may decide to shut down all 4 pairs or keep Channel 2 only still on.
- The rest is implementation specific (including current sharing needs which is handled at the PD side.)

Questions such

- DS vs SS
  - Any 2P system (af or at) is SS.
  - Any 4P system is actually 2x 2P system hence 4P PD has inherently DS
- Current sharing or not?
  - Each 2P required to meet current level specifications for Vport, Iport, Icut and Ilim
  - Can be implemented by active current sharing or functional isolation or nothing pending in Pport *and if it is Environment A or B.*
- Current sharing location
- If required, must be in the PD. Otherwise 4P=2x2P concept can't work economically wise.
  - Not cost effective to actively control two independent power sources of 2P
- Became easier to answer

Special cases analysis

– Case 1

– 2x2P sources are connected to 802.3af or 802.3at 2P MP using SS.

– Diode bridges tied together. Each 2P PSE reads class, hence allocated power may be twice then is needed at system level. Technically it is not a standard problem yet it is not a clean solution.

- Case 2

– 2x2P sources are connected to 4P PD.

– Each diode bridge is independently connected to Rsig and Class signature, hence each class reading is real reading, so allocated power is the sum of both channels readings.

- Case 3

– A PD that wish to use MP over all 4P may use SS or DS.

– If using DS, each class may be half the power or different ratio.

– If using SS, MP is taken from one of the 2P sources

Assuming the following

- Supporting the following PD types
  - 802.3af, 802.3at 2P
  - 802.3at 4P constructed from 2x2PMP
    - Single load or dual load
    - With or without current sharing
    - 12.95W<Power<MP or MP<Power<HP=2xMP
- Supporting the following PSE configurations
  - 802.3af,
  - 802.3at 2P
  - Dual 802.3at 2P on the same port, box and ground (Env A)
  - Dual 802.3at 2P from different ports on the same Boxes and grounds (Env A)
  - Dual 802.3at 2P from different ports or boxes or grounds (Env B)

Possible PD implementations in the market

#	PSE Port	PD type	PD load	Cable	SS Or DS	Requires Current Sharing
1	802.3af	-802.3af (O,5C)	single	2P or 4P	SS	NO
2	802.3at 2PMP	-802.3af (O,5C) -802.3at 2PMP	single	2P or 4P		
3	2X802.3 at 2P MP (Same port, box, Ground and Voltage Diff <TBD= ENV A)	-802.3af (O,5C)	single	2P or 4P		
		-802.3at 2PMP		2P or 4P		
4		-802.3at 4PHP	Single	4P	SS for each 2P.	**YES,** if TBD<P<MP **NO,** if P<TBD **or** functional isolation at the primary side of the PD. ***PD is defined as ENV A device.***
5			Dual independent			**NO**, if each channel is functionally isolated at the PD side. ***PD is defined as ENV A device.***

Notes

1. Current sharing is not required if **|I1-I2|<Idiff<Icut** otherwise overload condition will happen. **Idiff** is a function of **pair (I1) to pair (I2)** channel imbalance model.

Possible PD implementations in the market

#	PSE Port	PD type	PD load	Cable	SS Or DS	Requires Current Sharing
7	2 x 802.3at 2PMP (Environment B)	2 x 802.3af 2 x 802.3at 2P MP Y-Cable	Dual independent	4P	SS	NO
8	2 x 802.3at 2PMP (or 2x802.3af) (Environment B)	802.3at 4P HP	single	4P	SS for each 2P.	NO. Isolation must be supplied for ENV B.
9			Dual independent			NO. Isolation must be supplied for ENV B.

Possible non operational conditions

#	PSE Port	PD type	PD load	Cable	Comments
9	802.3af	802.3at 2PMP	single	2P or 4P	-May not work. -PD indication is issued. (O)
		802.3at 4PHP	Single or Dual	2P or 4P	-May not work. -PD indication is issued. (O) -Do we need separate indication for 4P?
10	802.3at 2PMP	802.3at 4PHP	Single	4P	
11	802.3at 2PMP	802.3at 4PHP	dual	4P	-May work

Not supporting Layer 2

#	PSE Port	PD type	PD load	Cable		Requires Current Sharing
6	802.3at 4PHP (Same Box, Port and Ground. Voltage Diff<TBD)=ENV A	2 x 802.3af 2 x 802.3at 2P MP Y cable (Splitted TOs)	Dual independent	4P		NO. Each channel is functionally isolated

Summary

- 2P System is the basic building block. 4P system is constructed by 2 x 2P system.
  - At least one of the 2P includes Ethernet capabilities to support layer 2.
- Hence a PD that requires power over 4 pairs should advertise detection and classification signature for each 2P.
  - Classification signature may be different for each 2P.
- Each 2P has its Status and Indications parameters
  - System decides how to treat effects of cross status and indications. E.g : in a 4P system, Channel 1 overloads. Channel 2 still works. System may decide to shut down all 4 pairs or each 2P.
- Current sharing if needed due to application or implementation, will be located at the PD.
  - PD pair to pair voltage differences requirements for ENV A and B PDs may be different to allow lower cost solutions for PD ENV A which is the major part in the market.
- The rest is implementation specific.
- No need for new isolation requirements
- No significant effects on Detection, Classification and power on timings per 2P

Annex

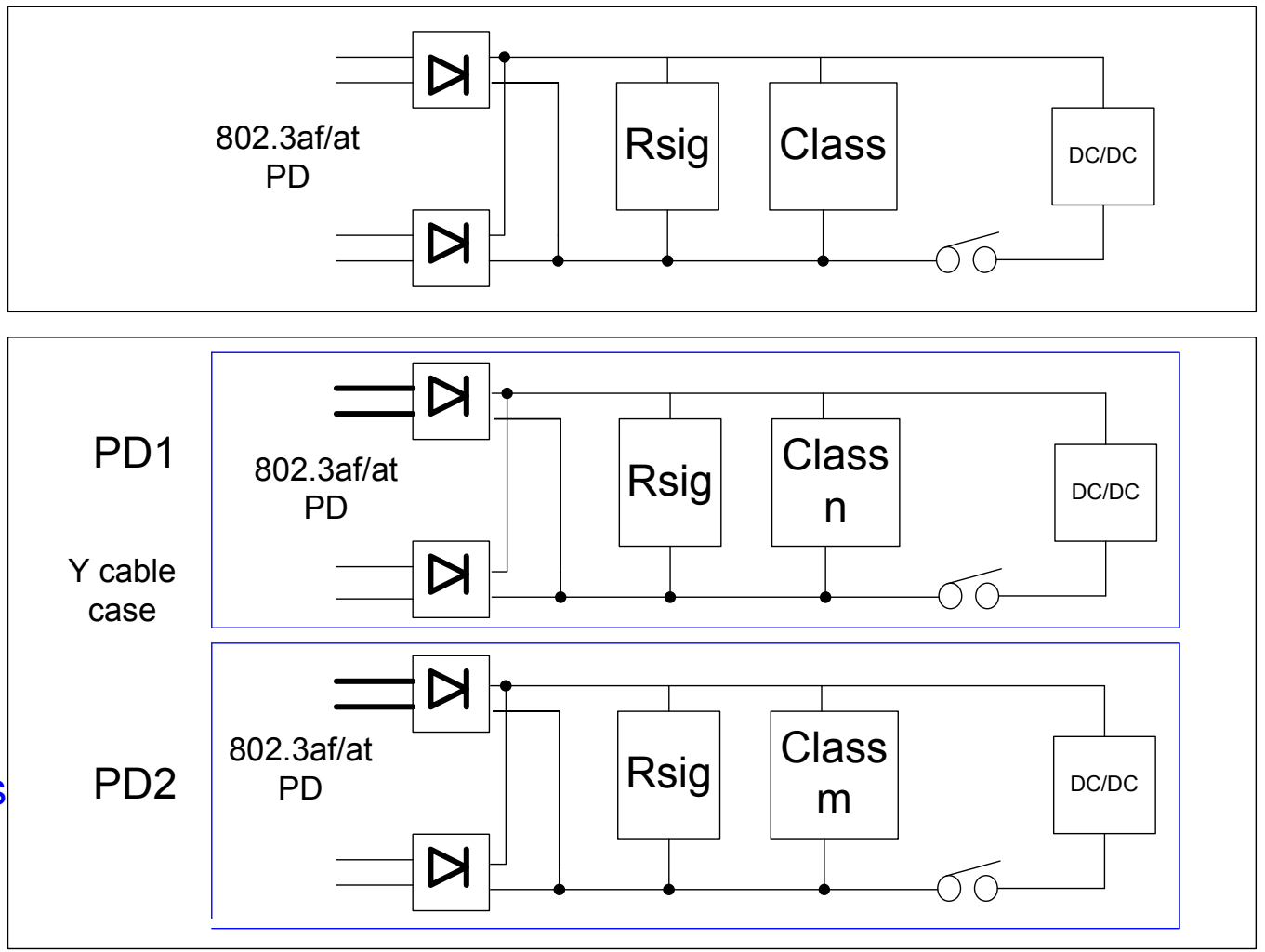
802.3afat 2P PDs – PD side

-Single Signature

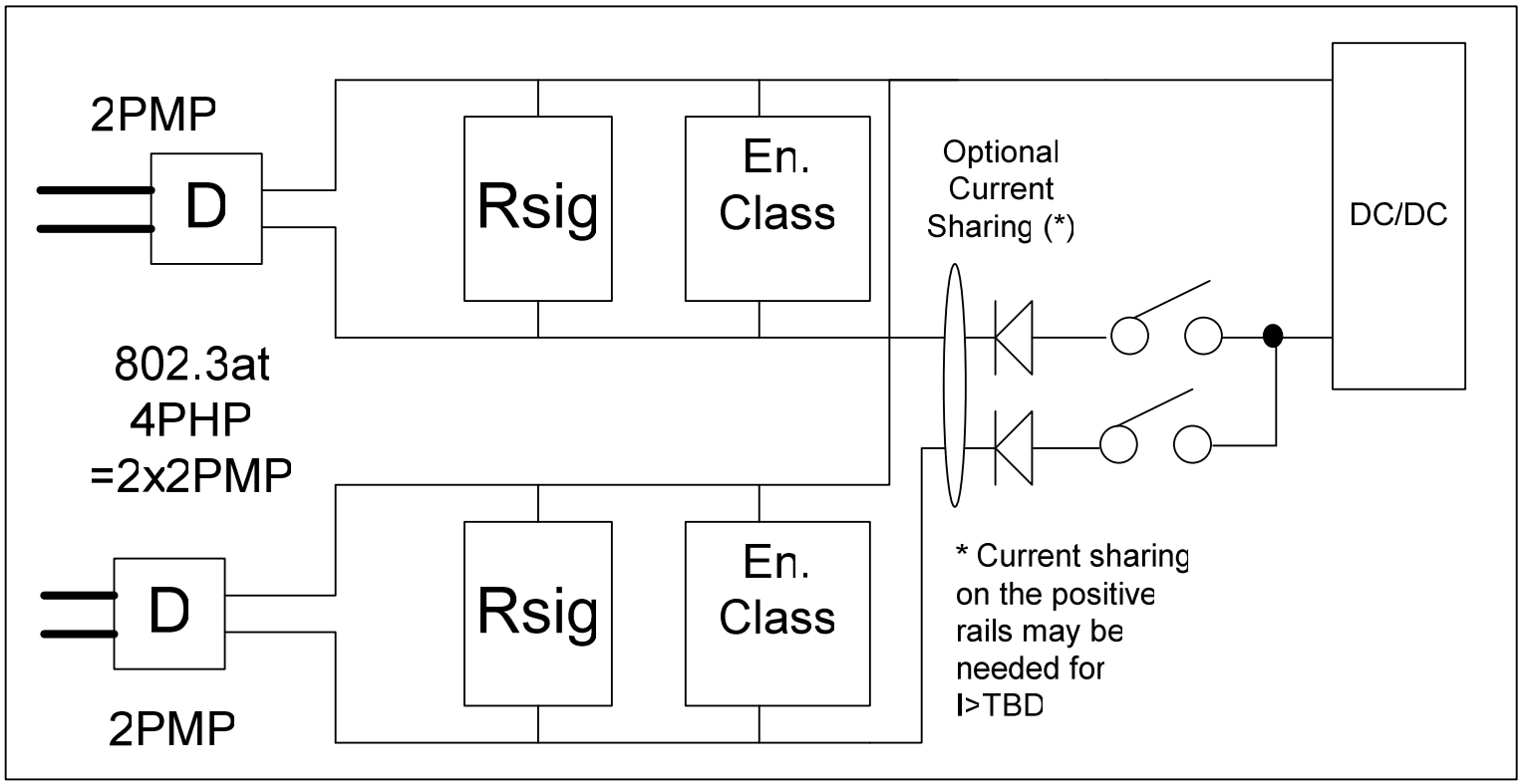
-Need to be supported by objectives

-Single Signature

-OK if each PSE source is Alternative A



802.3at 4P PD = 2x2P MP interface



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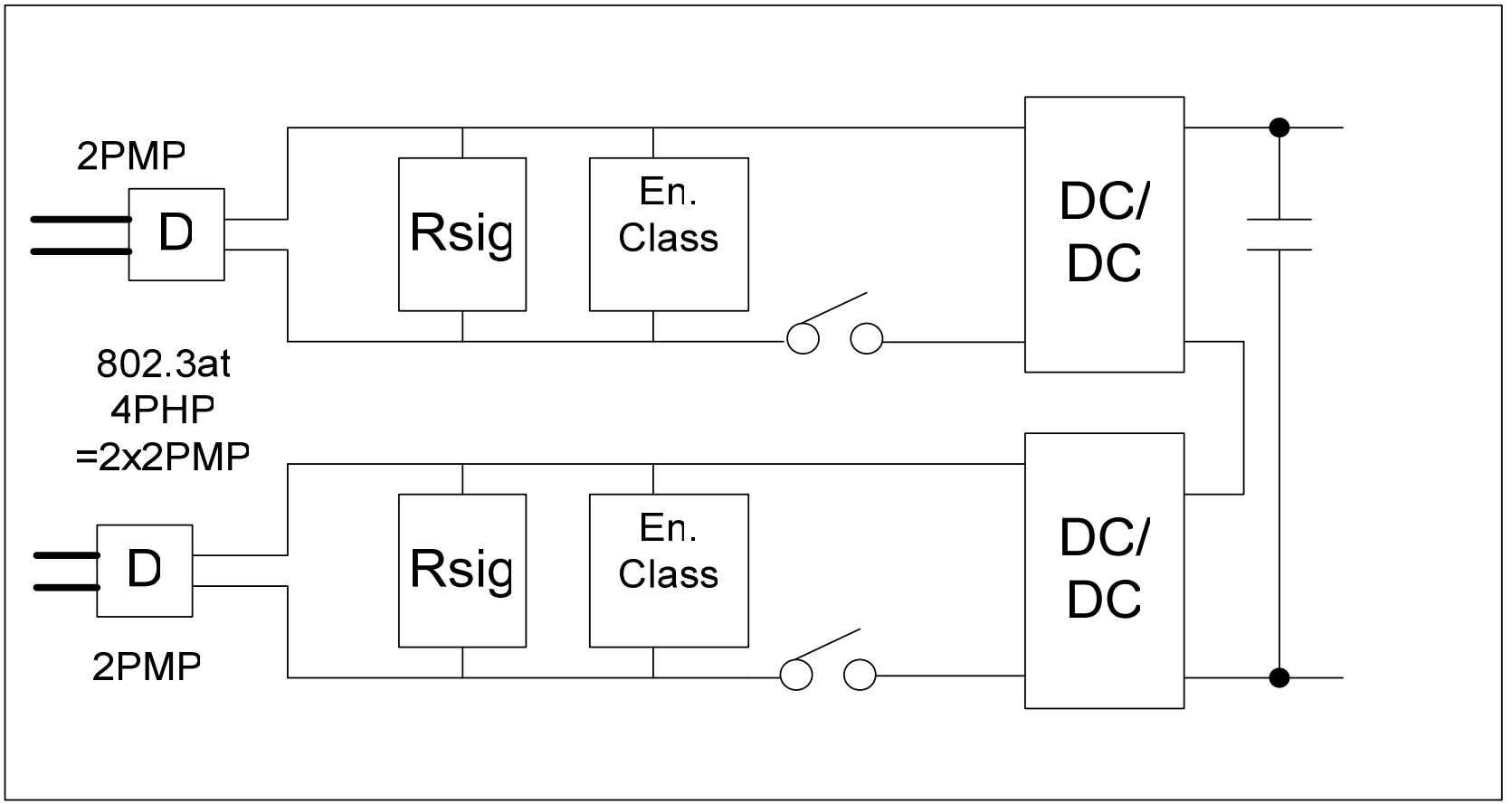
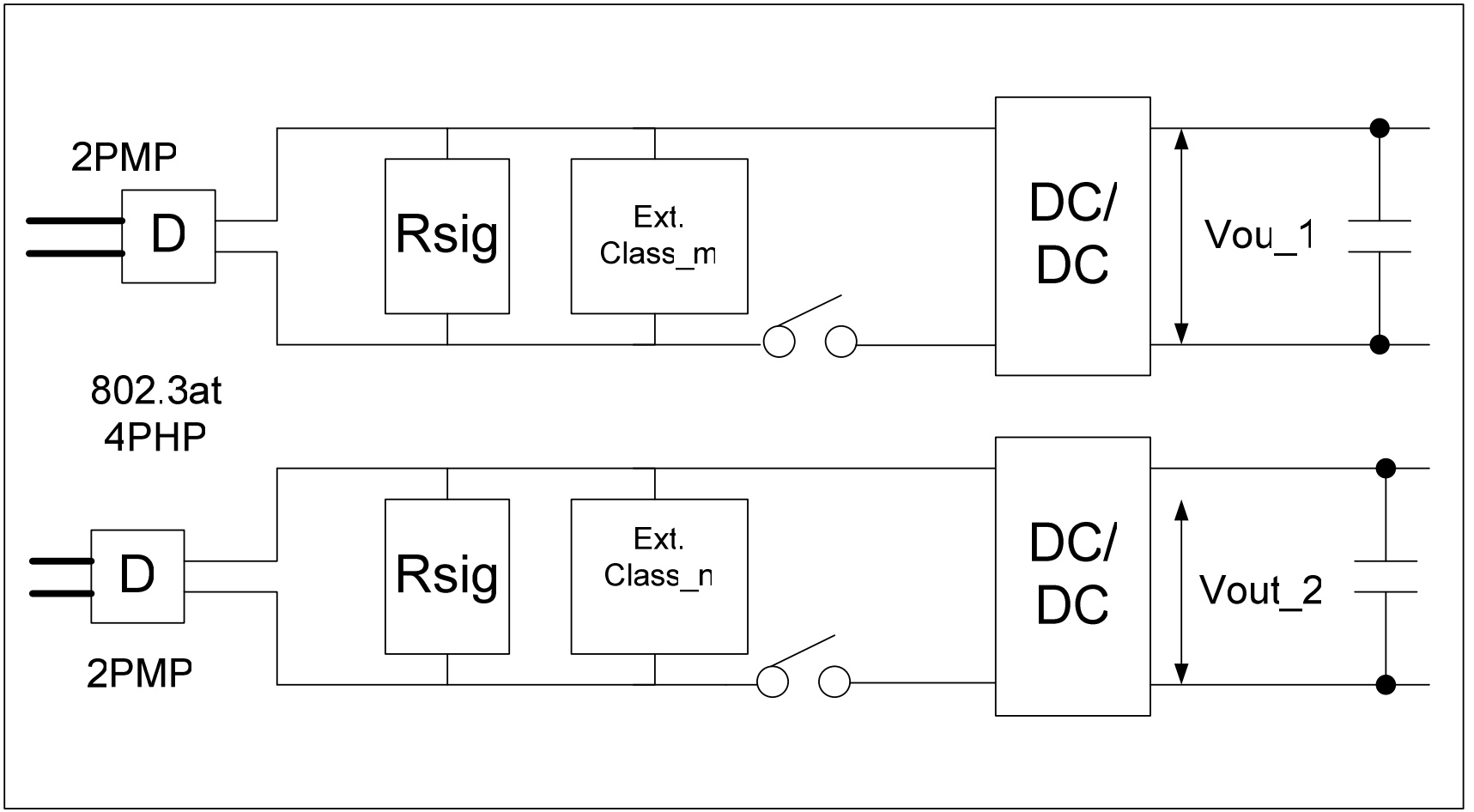


Simplified 4P PD without the need for Active Current Sharing in most high power applications

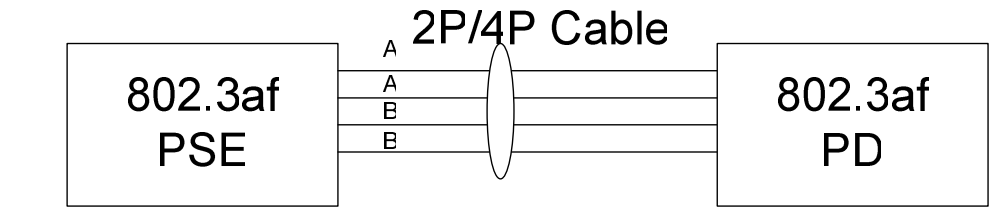
In this example each 2P has DC/DC however they operate on a single 4P PD load

802.3at 4P PD = 2x2P MP interface



Simplified 4P PD without the need for Active Current Sharing in most cases

802.3af, 802.3at 2P MP PDs – System Description

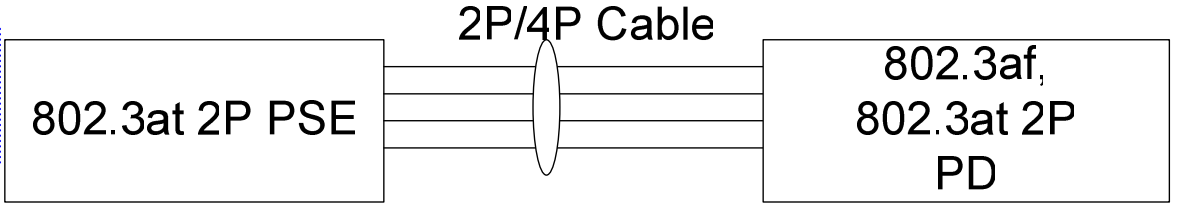


Case 1

Can't support layer 2 in 10/100BT
1000BT ? NEED TO BE DISCUSSED

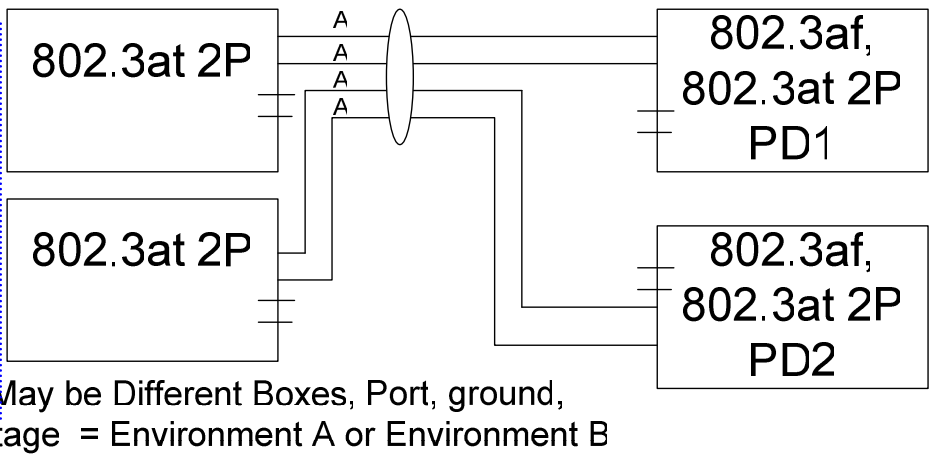
Case 6

-No known technical issues



-No known technical issues.

-Exists today for 802.3af and is not precluded by 802.3af

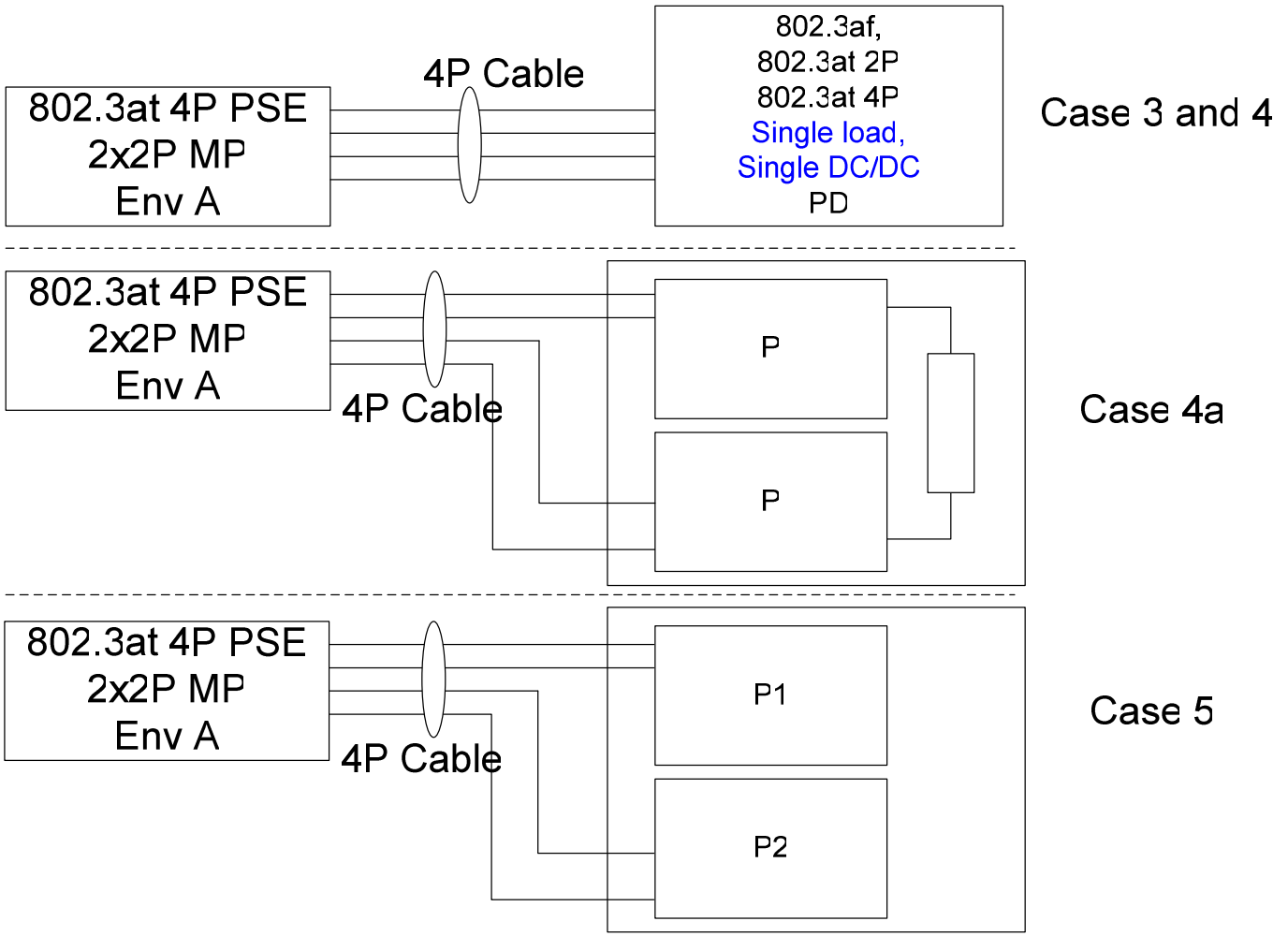


Y cable

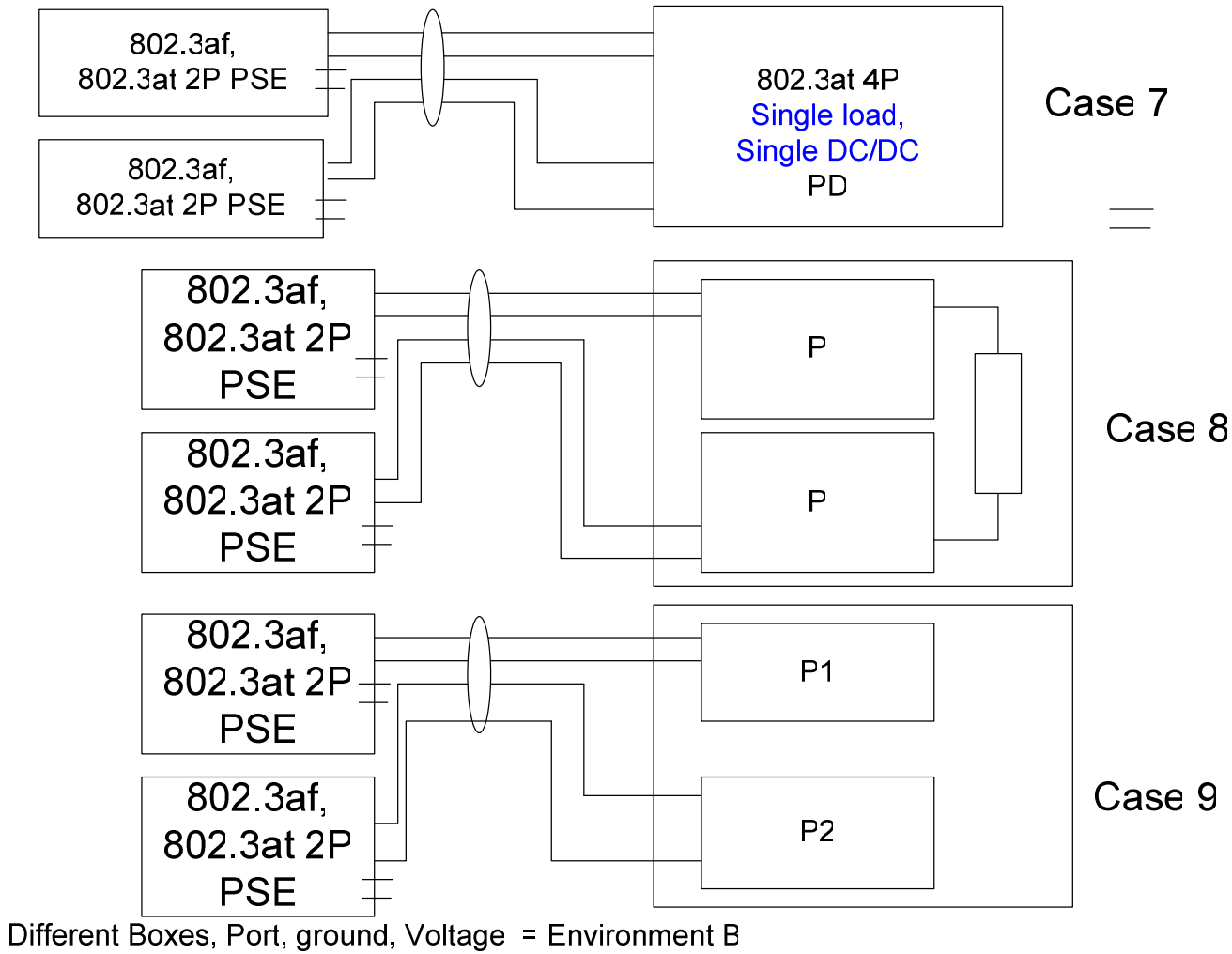
Case 7

May be Different Boxes, Port, ground,
Voltage = Environment A or Environment B

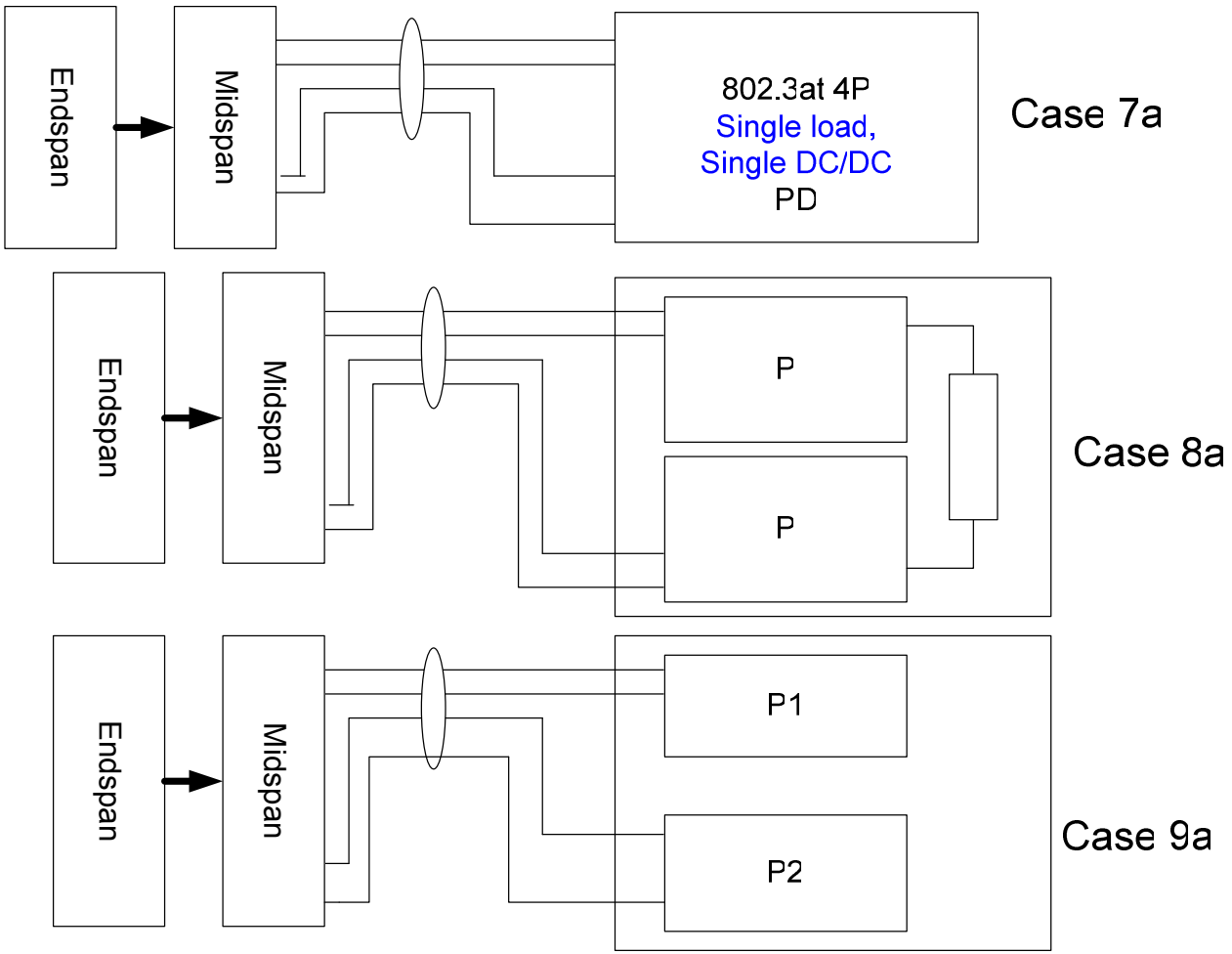
802.3at 4P HP PDs – System Description



802.3at 4P HP PDs – System Description



802.3at 4P HP PDs – System Description



Different Boxes, Port, ground, Voltage = Environment B